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Pethick, D., Hopkins, D. and McPhee, M. (2007) Development of intramuscular fat in prime lambs, young sheep and beef cattle. In: Agribusiness Sheep Updates, 24 - 25 July, Perth, Western Australia

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Development of intramuscular fat in prime lambs, young sheep and beef cattle

David Pethick¹, David Hopkins² & Malcolm McPhee

¹School of Veterinary and Biomedical Sciences, Murdoch University, Murdoch, WA,

²NSW Department of Primary Industries, Cowra, NSW, 2794

NSW Department of Primary Industries, University of New England, Armidale, NSW,

Cooperative Research Centre for Beef Genetic Technologies

The Cooperative Research Centre for Sheep Industry Innovation

ABSTRACT

Intramuscular fat (%) increases relatively slowly with carcass fatness (and weight) until a carcass fatness of about 35% is reached. This level of fatness is not compatible with profitable production systems for prime lambs and so there is no point in over conditioning lambs (beyond the minimum desirable fat score 2) in an effort to achieve eating quality benefits. Premiums paid for marbled beef in some markets allow production systems with fatter cattle to be profitable. Finally genetic selection for intramuscular fat can powerfully shift fat distribution toward the intramuscular site.

AIMS

Intramuscular fat is associated with juiciness and flavour of meat and so is one determinant of eating quality. The aims of this work were to (i) understand the maturity pattern of intramuscular fat deposition and (ii) compare intramuscular fat deposition in prime lambs, beef cattle and pigs.

METHOD

The data sets that were analysed to produce the results have been obtained from published serial slaughter experiments where defined groups of animals have been grown from light to heavy weights. The primary sources of data were obtained from: Australian Angus cattle (Pugh et al. 2005), Japanese Black x Holstein cattle (Aoki et al. 2001), Australian prime lambs/hoggets (Hopkins et al. 2007) and Australian modern pig genotypes (D'Souza et al. 2004). All data sets had measures of intramuscular fat (%) in the loin muscle and estimates of total carcass fatness based on either dissection or DXA scanning technology.

RESULTS

Figure 1. Relationship between loin fat (g) and total carcass fat (as a proportion of maturity) in lambs and young sheep.

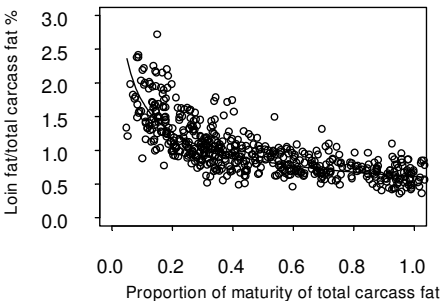
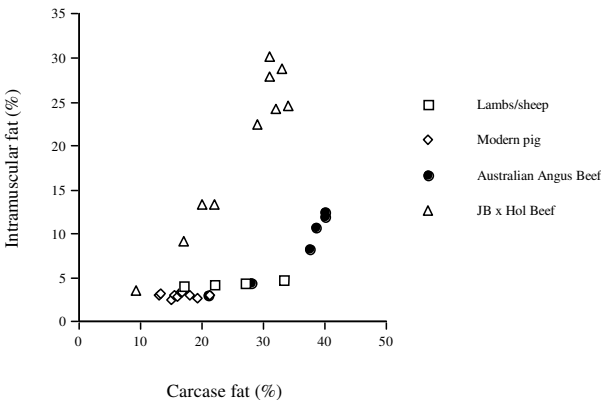


Figure 2. Relationship between carcass fat (%) and intramuscular fat (%) in the loin of Angus and Japanese x Holstein (JB x Hol) beef cattle, lambs/sheep and the modern pig.



The development of intramuscular fat as a depot in the loin of lambs/sheep is clearly early maturing in relation to total carcass fatness as a proportion of maturity (Figure 1). However the expression of intramuscular fat (%) is late maturing in selected cattle breeds (Figure 2). In the Australian cattle, sheep and pig breeds, intramuscular fat increases relatively slowly as carcass fatness (and also carcass weight) increases until about 35% carcass fatness. The Japanese Black cross cattle show an increase in intramuscular fat at all levels of carcass fatness compared to all other species/breeds. Pigs show the lowest levels of intramuscular fat at all levels of carcass fatness.

CONCLUSION

A common conclusion from previous animal development studies is that intramuscular fat is late developing compared to other carcass depots. This is clearly not correct in lambs/sheep (Figure 1) or in cattle (Pugh et al. 2005) when results are expressed as the weight of fat in muscle relative to weight of fat in the carcass. Of course the final trait, intramuscular fat (%), is late maturing since it is the result of continued fat synthesis and declining muscle accretion.

Despite the heterogenous nature of the experiments, variations in methodologies and that only carcass fatness has been reported, there is a compelling case that intramuscular fat (%) is related to total adiposity (and by difference muscularity). Excluding the Japanese Black cross cattle, it is clear that intramuscular fat (%) increases relatively slowly as animals fatten until a carcass fatness of about 30-35% is reached. At least for prime lambs and pigs, such levels of fatness are well beyond the limits that are compatible for profitable production systems and also consumer expectations for low level of salvage fat surrounding retail meat cuts. In the case of prime lambs there is virtually no eating quality gain associated with over fattening lambs and the minimum desirable fat score of 2 is enough. Premiums paid for marbled beef in some markets allow production systems with fatter cattle to be profitable. Clearly the Japanese Black cross cattle stand out as being very different since they develop intramuscular fat more strongly at lower levels of carcass fatness and this is the only breed in the data set to have undergone prolonged genetic selection for increased intramuscular fat. An interesting observation in the study of Hopkins et al. 2007 was the higher IMF levels due to the influence of Border Leicester genes, but the practical differences were small. These results emphasize the potential for genetic manipulation to shift the emphasis of fat deposition from one depot to another.

KEY WORDS

Beef, Lamb, Pork, Intramuscular Fat, Marbling

ACKNOWLEDGMENTS

The support of the Cooperative Research Centre for Beef Genetic Technologies and the The Cooperative Research Centre for Sheep Industry Innovation is gratefully acknowledged.

Referred by David Hopkins

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